CHAPTER 1

AN INTRODUCTION TO NETWORKING

After reading this chapter and completing the exercises, you will be able to:

- List the advantages of networked computing relative to standalone computing
- Identify the elements of a network
- Describe several specific uses for a network
- Distinguish between client/server and peer-to-peer networks
- Identify some of the certifications available to networking professionals
- Identify the kinds of nontechnical, or "soft," skills that will help you succeed as a networking professional

ON THE JOB

I never intended to be a networking professional. In high school my greatest love was reading, so I decided to study literature in college. I only used computers for writing term papers and e-mail. When I graduated from college, I don't think I even knew what a network was. With an English degree, I tried to find interesting jobs, and occasionally I did, but usually I wound up as a temp answering phones and typing all day.

One of the more interesting temporary jobs I had was at a pharmaceutical company, setting up laptop computers for their sales force. I installed software, tested the software, then shipped the machines to their owners. Soon I became fascinated with the hardware inside the machines and performed small repairs such as swapping out memory chips or fixing a keyboard connector. After I learned about PCs, I became more and more curious about the network: for example, how the laptop users picked up their e-mail while they were travelling. And before I knew it, I was supporting these users and troubleshooting the network problems that affected them. Because there was no one else around to help them, I had to learn quickly and without much formal training.

Since that time I've taken classes to fill in what I couldn't learn on the job. I've also met a lot of networking professionals who, like me, never intended to be in this field. In fact, very few of my colleagues have computer science degrees: some studied Music, Film, Microbiology, Russian, Meteorology, Math, Accounting, Mechanical Engineering, and the list goes on. We're all proof that you may wind up doing something entirely different from what you planned, but that you may enjoy it more than you imagined.

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Loosely defined, a **network** is a group of computers and other devices (such as printers) that are connected by some type of transmission media, usually wire or cable. The variations on the hardware, software, transmission media, and design of networks, however, are nearly infinite. Networks may consist of two computers connected by a cable in a home office or several thousand computers connected across the world via a combination of cable, phone lines, and satellite links. In addition to connecting personal computers, networks may link together mainframe computers, modems, CD-ROMs, printers, plotters, fax machines, and phone systems. They may communicate through copper wires, fiber-optic cable, radio waves, infrared, or satellite links.

All networks offer advantages relative to using a **standalone computer** (a personal computer that uses programs and data only from its local disks). Most importantly, networks enable multiple users to share devices and data that, collectively, are referred to as the networks' **resources**. For any organization, sharing devices saves money. For example, rather than buying 20 printers for 20 staff members, you can buy one printer and have those 20 staff members share it over a network. Sharing devices also saves time. For example, it's faster for co-workers to share data over a network than to copy data to a disk and transport it from one computer to another—an outdated method commonly referred to as **sneakernet** (presumably because people wore sneakers when walking from computer to computer). Before networks, transferring data via floppy disks (illustrated in Figure 1-1) was the only possible way to share data.

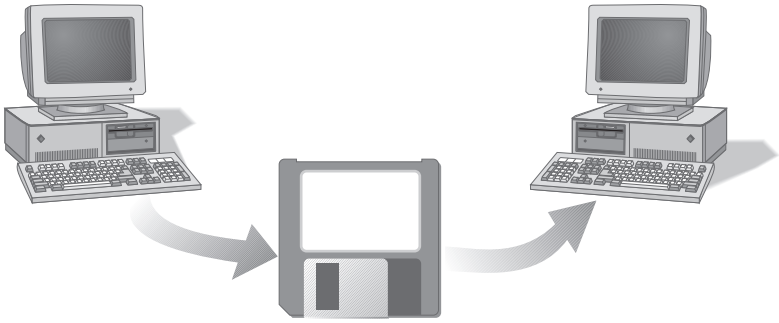

Figure 1-1 Data sharing before the advent of networks

Another advantage to networks is that they allow you to manage, or administer, hardware and software on multiple computers from one central location. Imagine you work in the Information Technology (IT) department of a multinational insurance company and must verify that each of 5000 insurance agents across the world uses the same version of WordPerfect. Without a network you could never keep up! Networks, along with network management software, allow you to manage computers in your office or around the world from one computer. The computer on which you are actually working is referred to as the **local computer**. The computer that you are controlling or working on via the network is referred to as the **remote computer**. Because they allow you to share devices and administer computers centrally, networks increase productivity. It's not surprising, then, that most businesses depend on their networks to stay competitive.

The simplest form of a network is a **peer-to-peer network**. In a peer-to-peer network computers communicate directly with other computers on a single segment of cable and share each others' data and devices, such as printers or CD-ROM drives. By default, no computer in a peer-to-peer network has more authority than another, and every computer can use resources from every other computer. Most computers in a peer-to-peer network are general-purpose personal computers that are not designed to handle heavy processing loads.

The primary advantage to using peer-to-peer networks is that they are simple to configure. For this reason, they are often used in environments where technical expertise is scarce. Peer-to-peer networks are also less expensive to set up and maintain than other types of networks. This fact makes them suitable for environments where saving money is critical. However, peer-to-peer networks are not very flexible. Once a peer-to-peer network is established, adding or changing significant elements of the network may be difficult. Peer-to-peer networks are also not very secure—meaning that data and other resources shared by network users can be easily discovered and used by unauthorized people. Finally, traditional peer-to-peer networks are not practical for connecting more than a handful of computers, because they do not necessarily centralize resources. For example, if your computer is part of a peer-to-peer network that includes five other computers, and each computer user stores his or her spreadsheets and word-processing files on his or her own hard disk, whenever your colleagues want to edit your files, they must attach to your machine on the network. If one colleague saves a changed version of one of your spreadsheets on her hard disk, you'll find it difficult to keep track of which version is the most current. As you can imagine, the more computers you add to a peer-to-peer network, the more difficult it becomes to find and track resources. Figure 1-2 shows an example of a peer-to-peer network.

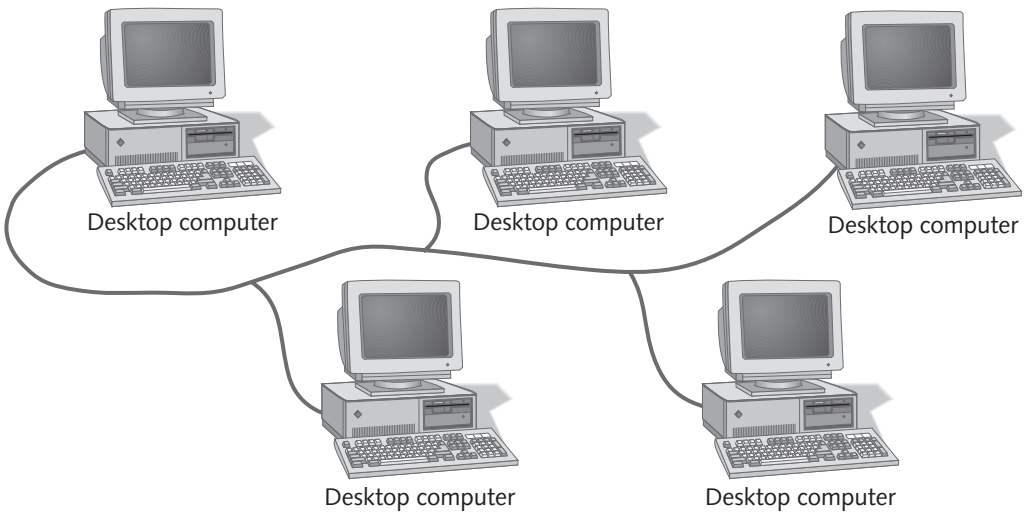

Figure 1-2 A simple peer-to-peer network

One way to establish a peer-to-peer network is by manipulating Windows 98 or Windows 2000 file-sharing controls. Peer-to-peer networks do not require a special network operating system such as Microsoft Windows 2000 Server or Novell NetWare. Instead, each user on this type of network can modify the properties of his or her desktop operating system to allow others to read and edit files on that particular computer's hard disk. Because access depends on many different users, it typically isn't uniform and may not be secure.

The peer-to-peer network is a very simple example of a local area network. As its name suggests, a **local area network (LAN)** is a network of computers and other devices that is confined to a relatively small space, such as one building or even one office. Small LANs became popular in businesses in the early 1980s. Today's LANs are typically larger and more complex than the peer-to-peer network in the previous example.

LANs involving many computers are usually server-based. On a **server-based network**, special computers, known as **servers**, process data for and facilitate communication between the other computers on the network, which are known as **clients**. Clients usually take the form of desktop computers, known as **workstations**. A network that uses a server to enable clients to share data, data storage space, and devices, is known as a **client/server network**. Because this is the most popular type of network, most of the networking concepts covered in this book and on the Net+ exam pertain to client/server networks.

The server's main job is to allow clients to share resources. To function as a server, a computer must be running a network operating system, such as Microsoft Windows 2000 Server, Novell NetWare, or UNIX. (By contrast, a standalone computer, or a client computer, uses a simpler operating system, such as Windows 98 or Windows 2000 Professional.) A **network operating system (NOS)** is special software designed to manage data and other resources on a server for a number of clients. Network operating systems also provide the ability to manage network security, network users and groups, protocols, and networked applications.

When designing a network, an engineer typically follows a plan, or model, which specifies the relationships between the various computers in the network. The term **client/server architecture** refers to a networking model in which clients (typically desktop PCs) use a central server to share applications, devices, and data. Every computer on a client/server network acts as a client or a server, and some computers may act as both. Clients on a network can still run applications from and save data to their local hard disk; a server, on the other hand, offers the option of using shared applications and data. Typically, clients on a client/server network do not communicate directly with each other, but rather use the server as an intermediate step in communications.

Usually, servers are more powerful computers than those found on a user's desktop. They may even be equipped with special hardware designed to provide network management functions beyond that provided by the network operating system. Figure 1-3 depicts a simple LAN that incorporates a server.

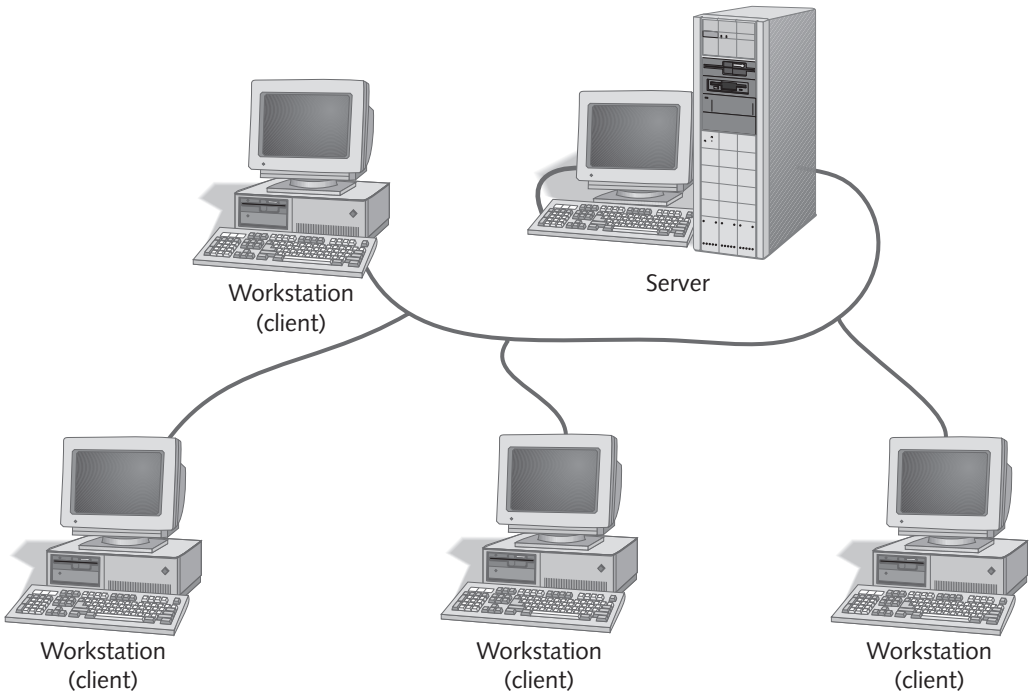

Figure 1-3 LAN with a file server

Networks are usually more complex than the simple LAN example in Figure 1-3. Often separate LANs are interconnected and rely on several servers running many different applications and managing resources other than data. For example, a single network may connect 15 servers, 200 workstations, 3 fax machines, 5 CD-ROM devices, 2 mainframes, and 7 scanners. Figure 1-4 depicts a more complex network.

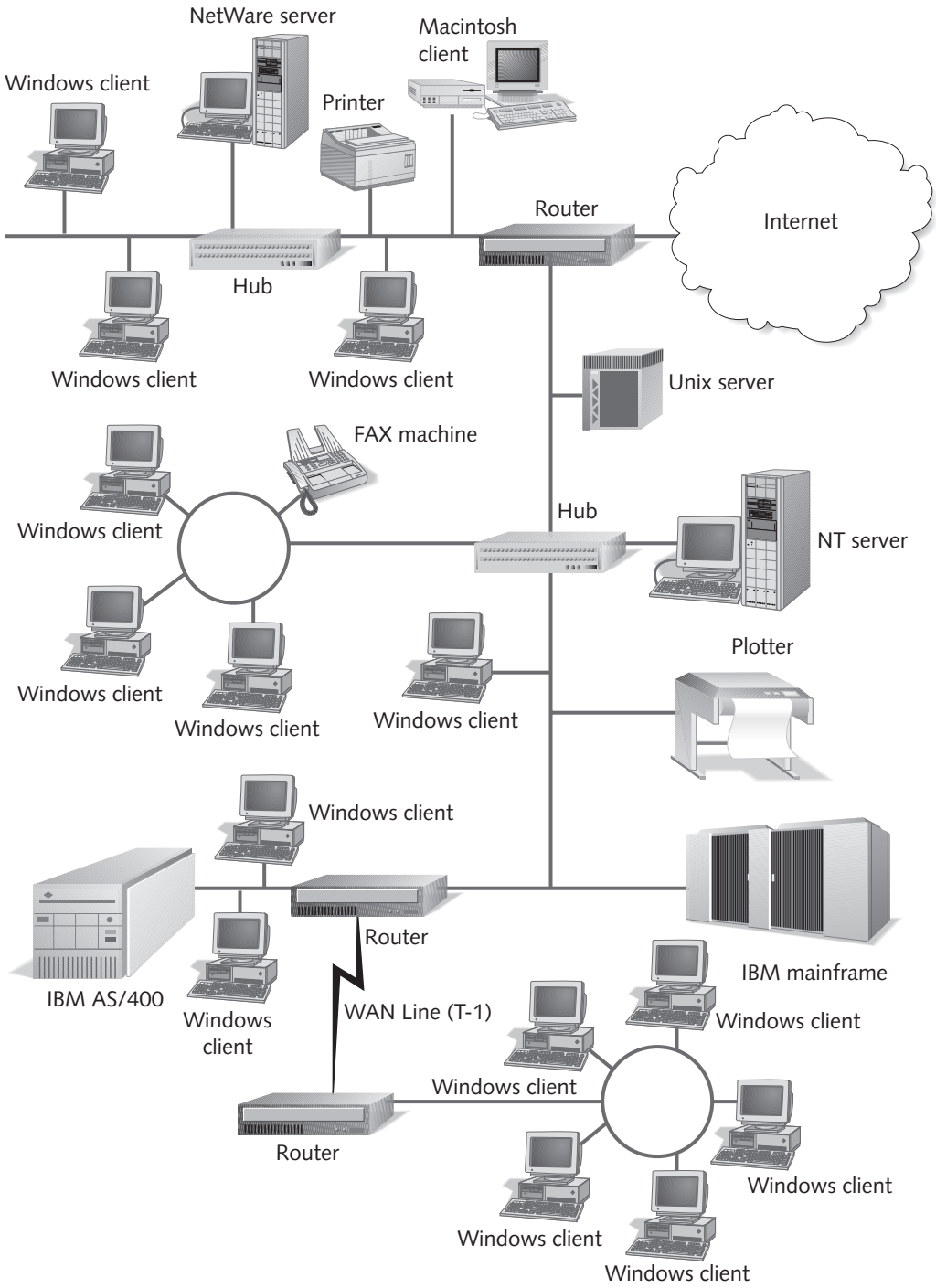

Figure 1-4 An example of a complex network

Don't worry if the network in Figure 1-4 looks overwhelming to you right now. As you progress through this book, you will learn about every part of this diagram. In the process, you will learn to integrate these pieces so as to create a variety of networks that are reliable, secure, and manageable.

The following list describes advantages of server-based networks relative to peer-to-peer networks:

- User login accounts and passwords for anyone on a server-based network can be assigned in one place.
- Access to multiple shared resources (such as data files or printers) can be centrally granted, by a single user or groups of users.
- Servers are optimized to handle heavy processing loads and dedicated to handling requests from clients.
- Because of their efficient processing and larger disk storage, servers can connect more than a handful of computers on a network.

Networks may extend beyond the boundaries of a building. A network that connects clients and servers in multiple buildings within a limited geographic area, for example, a handful of government offices surrounding a state capitol is known as a **metropolitan area network (MAN)**. A network that connects two or more geographically distinct LANs is called a **wide area network (WAN)**. Imagine you work for a nationwide software reseller that keeps its software inventory in warehouses in Topeka, Kansas, and Panama City, Florida. Suppose also that your office is located in New York. When a customer calls and asks whether you have 70 copies of Lotus Notes available to ship overnight, you need to check the inventory database located on servers at both the Topeka and Panama City warehouses. To access these servers, you would connect to the warehouses through a WAN link, then log on to their servers.

In fact, most organizations use WANs to connect separate offices, whether the offices are across town or across the world from each other. The **Internet** is an example of a very intricate and extensive WAN that spans the globe. Because they carry data over longer distances than LANs, WANs require slightly different technology and transmission media. WANs will be covered in detail in Chapter 7. Figure 1-5 depicts a simple WAN design.

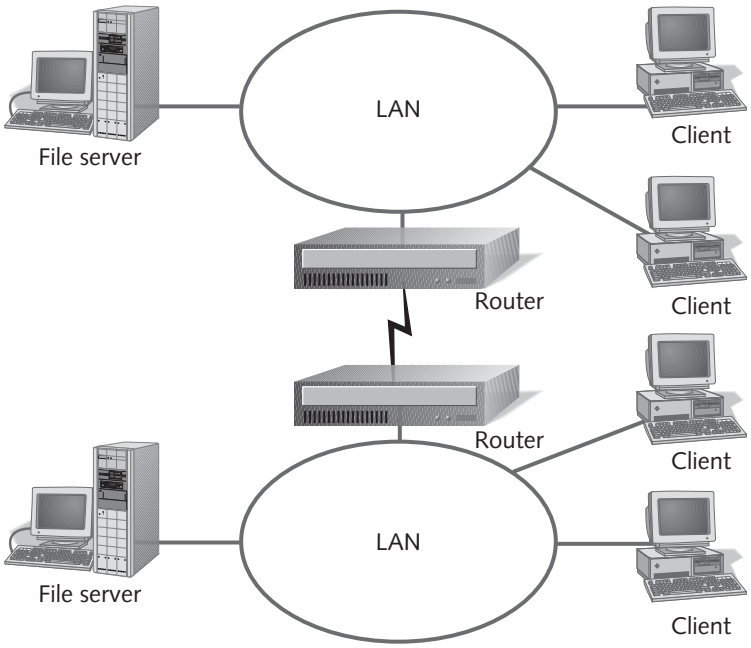

Figure 1-5 A simple WAN

Elements Common to All Server-Based Networks

You have learned that networks—no matter how simple or how complex—provide some benefits over standalone computers. They also share terminology and common building blocks, some of which you've already encountered. The following list provides a more complete rundown of basic elements common to all server-based networks. You will learn more about these topics throughout this book.

- *Client*. A computer on the network that requests resources or services from another computer on a network. In some cases, a client could also act as a server. The term "client" may also refer to the human **user** of a client workstation.
- *Server*. A computer on the network that manages shared resources. Servers usually have more processing power, memory, and hard disk space than clients. They run network operating software that can manage not only data, but also users, groups, security, and applications on the network.
- *Workstation*. A desktop computer, which may or may not be connected to a network. Most clients are workstation computers.
- *Network interface card (NIC)*. The device that enables a workstation to connect to the network and communicate with other computers. Several companies (such as 3Com, IBM, Intel, SMC, and Xircom) manufacture NICs, which

come with a variety of specifications that are tailored to the requirements of the workstation and the network. Figure 1-6 shows a typical workstation NIC.

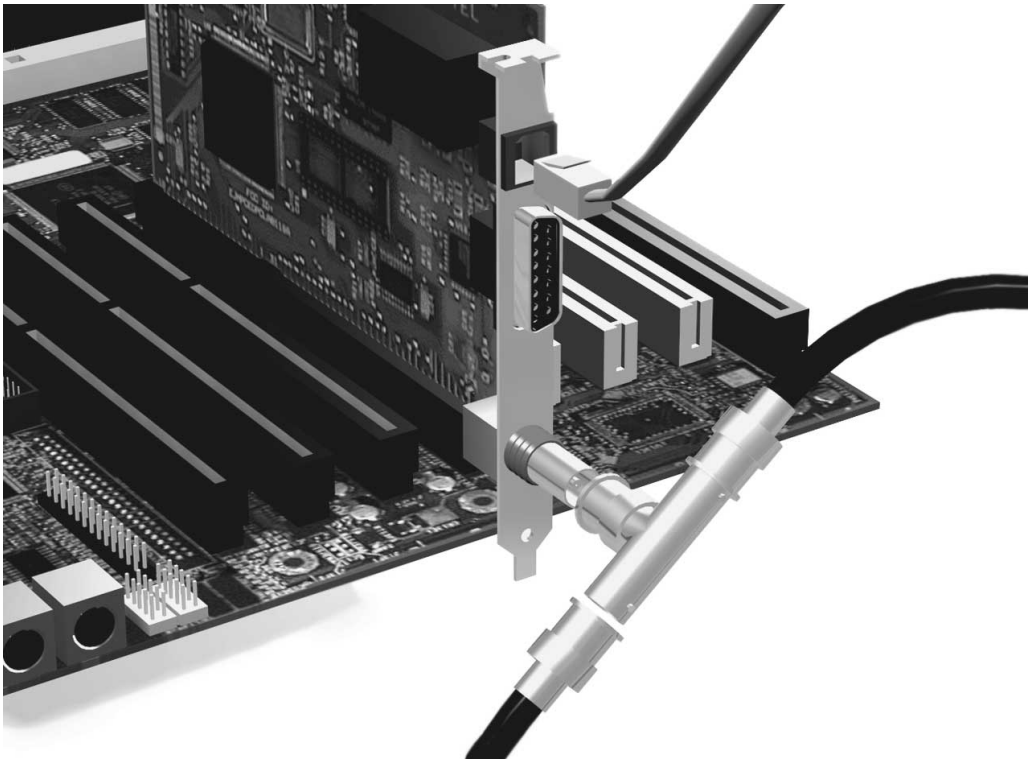

Figure 1-6 A network interface card (NIC)

Because different PCs and network types require different kinds of network interface cards, you cannot assume that a NIC that works in one workstation will work in another.

- *Network operating system (NOS).* The software that runs on a server and enables the server to manage data, users, groups, security, applications, and other networking functions. The most popular network operating systems are Microsoft Windows NT, Windows 2000, Novell NetWare, and UNIX.
- *Host.* A server that manages shared resources.
- *Node.* A client, server, or other device that can communicate over a network and that is identified by a unique identifying number, known as its network address.
- *Topology.* The physical layout of a computer network. Topologies vary according to the needs of the organization and available hardware and expertise.

Networks are usually arranged in a ring, bus, or star formation; hybrid combinations of these patterns are also possible. Figure 1-7 illustrates the most common network topologies, which you must understand to design and troubleshoot networks. (You will learn about topologies in detail in Chapter 5.)

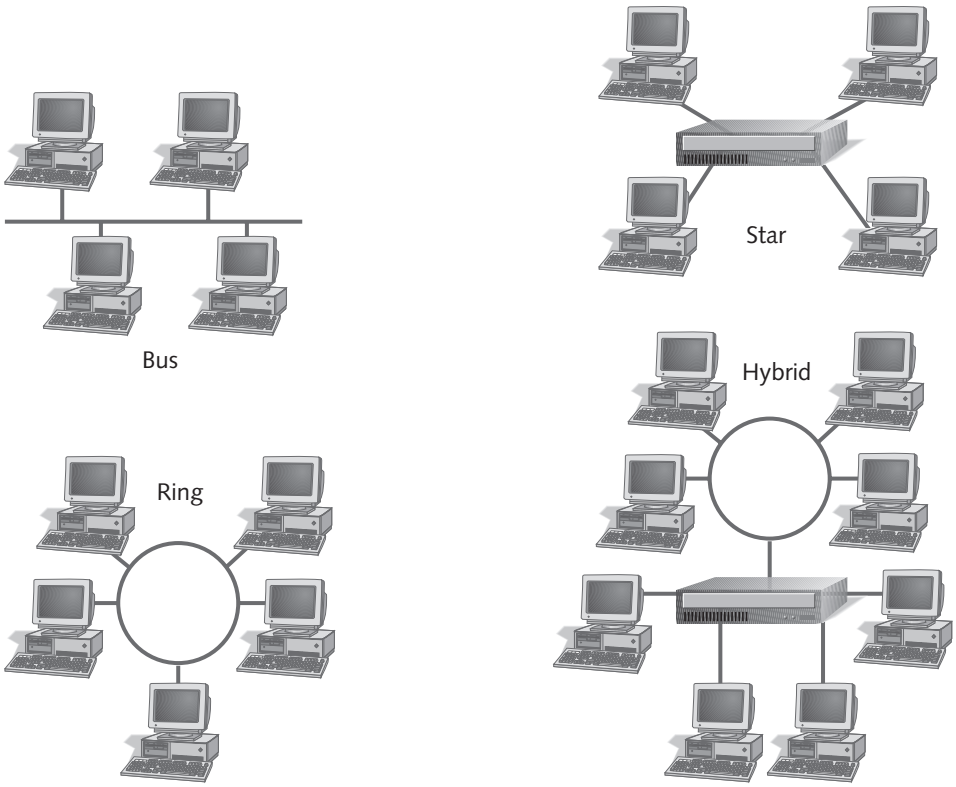

Figure 1-7 Commonly used network topologies

- *Protocol*. The rules that the network uses to transfer data. Protocols ensure that data are transferred whole, in sequence, and without error from one node on the network to another. To effectively maintain and manage a network, you must have a thorough understanding of network protocols. You will learn about network protocols in Chapter 3.
- *Data packets*. The distinct units of data that are transmitted from one computer on a network to another. Data packets are also known as datagrams, protocol data units (PDU), frames, or cells, depending on the context. You will learn more about data packets in Chapters 2 and 3.
- *Addressing*. The scheme for assigning a unique identifying number to every workstation and device on the network. The type of addressing used depends on the network's protocols and network operating system. It is important that each computer on a network have a unique **address** so that data can be

transmitted reliably to and from that computer. You will learn more about network addressing in Chapters 2 and 3.

- *Transmission media.* The means through which data are transmitted and received. Transmission media may be physical, such as wire or cable, or atmospheric (wireless), such as radio waves. You will learn more about transmission media in Chapter 4. Figure 1-8 shows several examples of transmission media.

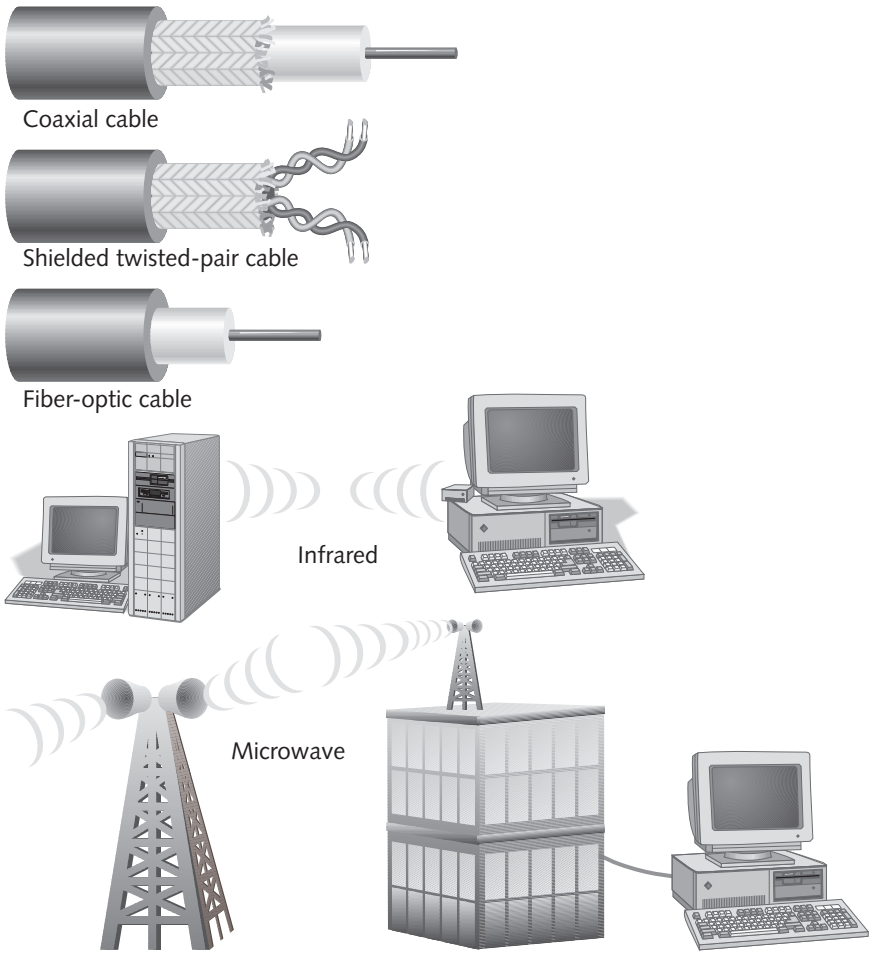

Figure 1-8 Examples of network transmission media

Now that you are familiar with basic network terminology, you are ready to appreciate the many uses of computer networks.

How Networks Are Used

The features provided by a network are usually referred to as **services**. Any network manager will tell you that the network service with the highest visibility is e-mail. If your company's e-mail system fails, users will notice within minutes—and they will not be shy about informing you of the failure. Although e-mail may be the most visible network service, other services are just as vital. Printer sharing, file sharing, Internet access, remote dial-in capabilities, mainframe communication, and management services are all critical business functions provided through networks. In large organizations, separate servers may be dedicated to performing each of these functions. In offices with only a few users and little network traffic, one server may perform all functions.

File and Print Services

File services refer to the capability of a server to share data files, applications (such as word-processing programs or spreadsheets), and disk storage space. File services accounted for the first use of networks and remain the foundation of networking today, for a number of reasons. A server that provides file services is called a **file server**. As mentioned earlier, it's easier and faster to store shared data at a central location than to copy files to a disk and then pass the disks around. Data stored at a central location are also more secure because, as the network administrator, you can take charge of backing up this data, rather than relying on individual users to make their own copies. In addition, using a file server to run applications for multiple users requires that fewer copies of the application be purchased and results in less maintenance work for the network administrator.

Using **print services** to share printers across a network also saves time and money. A high-capacity printer costs thousands of dollars, but can simultaneously print jobs for an entire department, thereby eliminating the need to buy a desktop printer for each worker. With one printer, less time is spent on maintenance and management. If a shared printer fails, the network administrator can diagnose the problem from a workstation anywhere on the network using the network operating system's printer control functions. Often, the administrator can solve the problem without even visiting the printer.

Communications Services

A network's communications services allow remote users to connect to the network (usually through a phone line and modem). (The term **remote user** refers to a person working on a computer in a different geographical location from the LAN's server.) Less frequently, communications services allow network users to connect to machines outside the network. Network operating systems such as Windows 2000 and NetWare include built-in communications services. In Windows 2000, the communications software is known as Remote Access Server (RAS). In NetWare, it is called Network Access Server (NAS). Both enable users to dial into a **communications server**, or the server running these communications services, then log in to the network and take advantage

of any network features, just as if they were logged in to a workstation in the server's home office.

Businesses and other organizations commonly use communications services to provide LAN access for workers at home, workers on the road, and workers at small satellite offices where WAN connections are not cost-effective. In addition, they may use communications services to allow staff from other organizations (such as a software or hardware vendor) to help diagnose a network problem. For example, suppose you work for a clothing manufacturer that uses embroidery software to sew insignias on shirts and hats. You are an expert on networking, but less adept with the automated embroidery software. When the software causes problems, you turn to the software vendor for help. If that software company is located in Australia, however, it's much easier and cheaper to allow the vendor's technician to dial in to your network through a communications server and remotely diagnose the software than to fly the technician to your office.

Communications servers are also referred to as **access servers** or **remote access servers**. It's important to remember that these servers—no matter which platform (hardware or operating system software) they run on—allow external users to use network resources and devices just as if they were logged in to a workstation in the office. From a remote location, users can print files to shared printers, log in to IBM mainframe hosts, retrieve mail from an internal messaging system, or run queries on internal databases. Because they can be accessed by the world outside the local network, communications servers necessitate strict security measures.

Mail Services

Mail services coordinate the storage and transfer of e-mail between users on a network. Users depend on e-mail for fast, convenient communication both within and outside the organization. In addition to sending, receiving, and storing mail, however, mail services can include e-mail routing capabilities (for example, forwarding a message to a supervisor automatically if a technical support representative has not opened that message within 15 minutes of receiving it), notification, scheduling, document management, and gateways to other mail servers. (A **gateway** is a combination of software and hardware that enables two different kinds of networks to exchange data.) Mail services can run on several kinds of systems; they may be connected to the Internet or may be isolated within an organization. Examples of mail services software include Microsoft's Exchange Server, NetWare's GroupWise, and Lotus's cc:Mail. Mail services are the most visible networking functions to users. As a result, their client interfaces (that is, the part of the software with which the user interacts) are usually well developed and easy to use. Also, because of their heavy use, mail services require a significant commitment of technical support and administration resources.

Internet Services

Gone are the days when businesses could remain competitive by using isolated local area networks. Today, global communication and data exchange is essential. The Internet, as the most far-reaching network in the world, has become a necessary tool. You have probably connected to the Internet already without knowing or caring about all of the services running behind the scenes. Once you establish a connection, your workstation and its accompanying servers must run standard protocols to use the Internet's features. **Internet services** include World Wide Web servers and browsers, file transfer capabilities, Internet addressing schemes, security filters, and a means for directly logging into other computers on the Internet. Internet services are a broad category of network functions; reflecting their growing importance, entire books have been devoted to them. You will learn more about Internet services in Chapter 11.

Management Services

When networks were small, they could be managed easily by a single network administrator and the network operating system's internal functions. For instance, suppose a user called to report a problem logging on to the network. The administrator diagnosed the problem as an addressing conflict (that is, two workstations having the same network address). In a very small network, the conflicting workstations might be located right around the corner from each other, and one address could be changed quickly. In another example, if a manager needed to report the number of copies of Lotus 1-2-3 in use in a certain department, the network administrator could probably get the desired information by just walking through the department and checking the various workstations.

As networks grow larger and more complex, however, they become more difficult to manage. To keep track of a large network, you need to employ special network management services. Network **management services** centrally administer and simplify complicated management tasks on the network, such as making sure that no more than 20 workstations are using WordPerfect at one time. Some organizations dedicate a number of servers to network management functions, with each server performing only one or two unique services.

Numerous services fall under the category of network management. Some of the most important services include the following:

- *Traffic monitoring and control*. Determining how much **traffic** (that is, data transmission and processing activity) is taking place on a network or network segment and notifying administrators when a segment becomes overloaded. A **segment** is a part of a LAN that is logically separated from other parts of the LAN and that shares a fixed amount of traffic capacity. In general, the larger the network, the more critical it is to monitor traffic.

- *Load balancing*. Distributing processing activity evenly across a network so that no single device becomes overwhelmed. Load balancing is especially important for networks where it's difficult to predict the number of requests that will be issued to a server, as is the case with Web servers.
- *Hardware diagnosis and failure alert*. Determining when a network component fails and automatically notifying the network administrator through e-mail or paging.
- *Asset management*. Collecting and storing data on the number and types of software and hardware assets (or resources) in an organization's network. The data collection process, in which each network client is examined electronically, takes place automatically. In the past, these data were typically gathered manually from paper records and typed into spreadsheet forms.
- *License tracking*. Determining how many copies of a single application are currently in use on the network. This information is important for legal reasons, as the concern over illegal software copying and excessive usage grows.
- *Security auditing*. Evaluating what security measures are currently in force and notifying the network administrator if a security breach occurs.
- *Software distribution*. Automatically transferring a data file or program from the server to a client on the network. Software distribution can be initiated from either the server or the client. Several options are available when distributing software, such as warning users about updates, writing changes to a workstation's system files, and restarting the workstation after the update.
- *Address management*. Centrally managing a finite number of network addresses for an entire LAN. Usually this task can be accomplished without touching the client workstations.
- *Backup and restoration of data*. Copying (or **backing up**) critical data files to a secure storage area and then **restoring** (or retrieving) data if the original files are lost or deleted. Often backups are performed according to a formulaic schedule. Backup and data restoration services provide centralized management of data backup on multiple servers and on-demand restoration of files and directories.

Network management services will be covered in depth in Chapters 12 through 13 of this book. For now, it is enough to be aware of the variety of services and the importance of this growing area of networking.

Becoming a Networking Professional

Examine the classified ad section of any newspaper, and you will probably find more ads for computer professionals than any other kind of skilled worker. Of course, the level of expertise required for each of these jobs differs. Some companies simply need "warm bodies" to ensure that a mainframe's tape backup doesn't fail during the night; other companies are looking for people to plan their information technology strategies.

Needless to say, the more varied your skills, the better your chances for landing a lucrative and interesting job in networking. To prepare yourself to enter this job market, you should master a number of general networking skills. Only then should you pick a few areas that interest you and study those specialties. Hone your communication and teamwork skills, and stay abreast of emerging technologies. Consider the tremendous advantages of attaining professional certification and getting to know others in your field. The following sections offer suggestions on how to approach a career in networking.

Mastering the Technical Challenges

Although computer networking is a varied field, some general technical skills will serve you well no matter which specialty you choose. Because you are already interested in computers, you probably enjoy an aptitude for logical and analytical thinking. You may also want to acquire these skills:

- Installing, configuring, and troubleshooting network server software
- Installing, configuring, and troubleshooting network server hardware
- Installing, configuring, and troubleshooting network client software
- Installing, configuring, and troubleshooting network client hardware
- Understanding the characteristics of different transmission media
- Understanding network design
- Understanding network protocols
- Understanding how users interact with the network

Because you can expand your networking knowledge in almost any direction, you should pay attention to the general skills that interest you most, then pick one or two of those areas and concentrate on them. If you try to become a specialist in everything at once, you are likely to become frustrated. The following specialties are currently in high demand:

- Network security
- Internet and intranet design
- Network management
- Voice/data integration
- Remote and mobile computing
- Data integrity and fault tolerance
- In-depth knowledge of Microsoft networking products
- In-depth knowledge of NetWare networking products
- In-depth knowledge of router configuration and management

Determine what method of learning works best for you. A small classroom with an experienced instructor and a hands-on projects lab is an excellent learning environment, because there you can ask questions and learn by doing. Many colleges offer courses or continuing education on networking topics. You may also want to enroll at a computer training center. These training centers can be found in every metropolitan area and even many small towns. If you are pursuing certification, make sure the training center you choose is authorized to provide training for that certification. Most computer training centers also operate a Web site that provides information on their course schedule, fees, and qualifications. Some of these sites even offer online class registration.

Another great way to improve your technical skills is by gaining practical experience. There is no substitute for hands-on experience when it comes to networking hardware and software skills. If you don't already work in an Information Technology department, try to find a position that puts you in that environment, even if it isn't your dream job. Volunteer a few hours a week if necessary. Once you are surrounded with other information technology professionals and encounter real-life situations, you will have the opportunity to expand your skills by practicing and asking questions of more experienced staff. On the Web, you can find a number of searchable online job boards and recruiter sites. The placement office at your local college or university can also connect you with job opportunities.

If you already work in an Information Technology department, you should pay close attention to the technical issues and trends, experiment, and ask lots of questions.

If your organization offers a mentoring program, participate in it. If not, find an unofficial mentor among your experienced colleagues who is willing to spend extra time explaining technical details to you. Chances are, your colleague will be honored to be chosen and eager to help.

Developing Your "Soft Skills"

Knowing how to configure a router or install Windows 2000 will serve you well, but without advanced soft skills, you cannot excel in the networking field. The term **soft skills** refers to those skills that are not easily measurable, such as customer relations, oral and written communications, dependability, teamwork, and leadership abilities. Some of these soft skills might appear to be advantages in any profession, but they are especially important when you must work in teams, in challenging technical circumstances and under tight deadlines—characteristics that apply to most networking projects. For this reason, soft skills merit closer examination.

- *Customer relations*. Perhaps one of the most important soft skills, customer relations involve an ability to listen to customers' frustrations and desires and then empathize, respond, and guide customers to their goals without acting arrogant. Bear in mind that some of your customers will not appreciate or enjoy technology as much as you do, and they will value your patience as you help

them. The better your customer relations, the more respected and in demand you will be as a network professional.

- *Oral and written communications.* You may understand the most complicated technical details about a network, but if you cannot communicate them to colleagues and clients, the significance of your knowledge is diminished. Imagine that you are a networking consultant who is competing with another firm to overhaul a metropolitan school district's network, a project that could generate $10 million in business for your company. You may have designed the best solution and have it clearly mapped out in your head, but your plan is useless if you can't convey it. The members of the school board will accept whichever proposal makes the most sense to them—that is, the proposal whose suggestions and justifications are plainly communicated.
- *Dependability.* This characteristic will help you in any career. However, in the field of networking, where breakdowns or glitches can occur at any time of day or night and only a limited number of individuals have the expertise to fix them, being dependable is critical. Your career will benefit when you are the one who is available to address a problem, even if you don't always know the answer immediately.
- *Teamwork.* Individual computer professionals often have strong preferences for a certain type of hardware or software. And some technical people like to think that they have all of the answers. For these and other reasons, teamwork in Information Technology departments is often lacking. To be the best networking professional in your department, you must be open to new ideas, encourage cooperation among your colleagues, and allow others to help you and make suggestions.
- *Leadership abilities.* As a networking professional, you will sometimes need to make difficult or unpopular decisions under pressure. You may need to persuade opinionated colleagues to try a new product, tell a group of angry users that what they want is not possible, or manage a project with nearly impossible budgetary and time restrictions. In all of these situations, you will benefit from having strong leadership skills.

Once your career in networking begins, you will discover which soft skills you already possess and which ones you need to cultivate. The important thing is that you realize the importance of these attributes and are willing to devote the time necessary to develop them.

Pursuing Certification

Certification is the process of mastering material pertaining to a particular hardware system, operating system, programming language, or other software program, then proving your mastery by passing a series of exams. Certification programs are developed and administered either by a manufacturer or a professional organization such as the **Computing Technology Industry Association (CompTIA)**. You can pursue a number of different certifications, depending on your specialty interest. For example, if you

want to become a PC technician, you should attain **A+** certification. If you want to specialize in Microsoft product support and development, you should pursue **Microsoft Certified Systems Engineer (MCSE)** certification. If you want to specialize in Novell networking product support and administration, you should pursue **Certified NetWare Engineer (CNE)** certification. If you want to prove a mastery of many aspects of networking, you should choose to become Network+ certified. **Network+ (Net+)** is a professional certification established by CompTIA that verifies broad, vendor-independent networking technology skills such as an understanding of protocols, topologies, networking hardware, and network troubleshooting. Net+ may also be a stepping stone to more advanced certifications. For example, Novell now accepts Net+ certification as a substitute for its Networking Technologies exam for candidates pursuing CNE status. The material in this book addresses the knowledge objectives required to qualify for Net+ certification.

Certification is a popular career development tool for job seekers and a measure of an employee's qualifications for employers. Following are a list of benefits you can expect after becoming certified:

- *Better salary*. Professionals with certification can usually ask for higher salaries than those who aren't certified. Employers will also want to retain certified employees, especially if they helped pay for their training, and will offer incentives to keep certified professionals at the company.
- *Greater opportunities*. Certification may qualify you for additional degrees or more advanced technical positions.
- *Professional respect*. Once you have proved your skills with a product or system, your colleagues and clients will have great respect for your ability to solve problems with that system or product. They will therefore feel confident asking you for help.
- *Access to better support*. Many manufacturers reward certified professionals with less expensive, more detailed, and more direct access to their technical support.

One potential drawback of some certifications is the number of people attaining them—so many that they now have less value. Currently, hundreds of thousands of networking professionals have acquired the MCSE certification. When only tens of thousands of people had MCSEs, employers were willing to pay substantially higher salaries to workers with that certification than they are now. Other kinds of certifications, such as Cisco's Certified Internetworking Engineer (CCIE) program, require candidates to pass lab exams. These kinds of certifications, because they require rigorous proof of knowledge, are very highly respected.

Finding a Job in Networking

With the proper credentials and demonstrated technical knowledge, you will qualify for a multitude of positions in networking. For this reason, you can and must be selective when searching for a job. Following are some ways to research your possibilities:

- *Search the Web*. Because your job will deal directly with technology, it makes sense that you should use technology to find it. Companies in the computer industry recruit intensively on the Web, either through searchable job databases or through links on their company Web sites. Unlike firms in other industries, these companies typically do not mind (and might prefer) receiving résumés and letters through e-mail. Most job database Web sites do not charge for their services or require you to register with them. Table 1-1 lists a few of these Web sites, some of which are devoted exclusively to posting information technology positions. The table provides just a sample of the best-known job databases on the Web; you could probably find hundreds more.

Table 1-1 Web sites with job databases

Web Site Location	Description and Emphasis
www.informationweek.com/career3	InformationWeek's "Best Jobs": an IT career site with links to job searches, career advice, salary surveys, and training sites
www.hotjobs.com	HotJobs: a searchable site for job seekers and employers from around the world and from many different industries
www.careerweb.com	Career Web: a searchable site for job seekers and employers from around the United States and from many different industries
www.monster.com	The Monster Board: a searchable site for job seekers and employers from around the world and from many different industries
www.ajb.dni.us	America's Job Bank: a searchable site for job seekers and employers from around the world and from many different industries
www.headhunter.net	Headhunter.net: a searchable site for job seekers and employers from around the United States and from many different industries
www.careerbuilder.com	Career Builder: a list of links to numerous searchable job databases and other career resources

- *Read the paper*. An obvious place to look for jobs is the classified ad section of your local newspaper. Papers with large distributions often devote a section of their classified ads to careers in computing. Highlight the ads that sound interesting to you, even if you don't have all of the qualifications cited by the

employer. In some ads, employers will list every skill they could possibly want a new hire to have, but they don't truly expect one person to have all of them.

- *Visit a career center*. Regardless of whether you are a registered university or college student, you can use career center services to find a list of job openings in your area. Companies that are hiring pay much attention to the collegiate career centers because of the number of job seekers served by these centers. Visit the college or university campus nearest you and search through its career center listings.
- *Network*. Find like-minded professionals with whom you can discuss job possibilities. You may meet these individuals through training classes, conferences, professional organizations, or career fairs. Let them know that you're looking for a job and specify exactly what kind of job you want. If they can't suggest any leads for you, ask these people if they have other colleagues who might.
- *Attend career fairs*. Most metropolitan areas host career fairs for job seekers in the information technology field, and some large companies host their own job fairs. Even if you aren't sure you want to work for any of the companies represented at a job fair, attend the job fair to research the market. You can find out which skills are in high demand in your area and which types of companies are hiring the most networking professionals. You can also meet other people in your field who may offer valuable advice based on their employment experience.

Joining Professional Associations

At some point in your life, you have probably belonged to a club or organization. You know, therefore, that the benefits of joining can vary, depending on many factors. In the best case, joining an organization can connect you with people who have similar interests, provide new opportunities for learning, allow you to access specialized information, and give you more tangible assets such as free goods. Specifically, a networking professional organization might offer its own journal, technical workshops and conferences, free software, pre-release software, and access to expensive hardware labs. Some associations even offer health insurance benefits to their members.

You can choose from several prominent professional organizations in the field of networking. Because the field has grown so quickly and because so many areas in which to specialize exist, however, no single professional organization stands out as the most advantageous or highly respected. You will have to decide whether an organization is appropriate for you. Among other things, you will want to consider the organization's number of members, membership benefits, membership dues, technical emphasis, and whether it hosts a local chapter. You may also want to find a professional association that caters to your demographic group (such as Women in Technology International, if you are female). Table 1-2 lists a number of professional organizations and their Web sites.

Table 1-2 Web sites of networking organizations

Professional Organization	Emphasis	Web Site
Network Professional Association	All disciplines, all groups	www.npa.org
Association for Computing Machinery (ACM)	All disciplines, all groups	www.acm.org
IEEE Computer Society	Advanced computing, all groups	www.computer.org
Network and Systems Professionals Association	All disciplines, all groups	www.naspa.net
Information Technology Association of America	All disciplines, all groups	www.itaa.org
Chinese Information and Networking Association	All disciplines, Chinese Americans	www.cina.org
Women in Technology International	All disciplines, women	www.witi.com

Chapter Summary

- A network is a group of computers and other devices that are connected by some type of transmission media, usually wire or cable.
- Networks may consist of two computers connected by a cable in a home office or several thousand computers connected across the world. In addition to connecting personal computers, they may incorporate mainframe computers, modems, CD-ROMs, printers, plotters, fax machines, or phone systems. Computers on a network may communicate through cables, wires, radio waves, infrared, or satellite links.
- All networks provide advantages relative to a standalone personal computer. Most importantly, networks enable multiple users to share devices and data. They also allow for centralized administration of hardware and software.
- The simplest form of a network still used today connects a handful of computers through one cable and uses peer-to-peer communication. Peer-to-peer communication enables computers to talk directly to other computers on a single segment of cable, without any computer having more authority than another.
- A local area network (LAN) is a network of computers and other devices that is confined to a relatively small space, such as one building or even one office. A peer-to-peer network is a simple example of a LAN. More complex LANs are server-based and rely on a central file server to manage resources.
- A network that connects two or more geographically distinct LANs is called a wide area network (WAN).
- All server-based networks share some common elements, including clients, servers, workstations, transmission media, protocols, addressing, topology, network interface cards, data packets, network operating systems, hosts, and nodes.

- The physical layout of a computer network is called a topology. Topologies are usually arranged in a ring, bus, or star formation; hybrid combinations of these patterns are also possible. You must understand topologies to design and troubleshoot networks.
- Network protocols are the rules that the network uses to transfer data. Protocols ensure that data are transferred whole, in sequence, and without error from one node on the network to another. To effectively maintain and manage a network, you must have a thorough understanding of network protocols.
- Although e-mail is the most visible network service, networks also provide services for printing, file sharing, Internet access, remote dial-in capabilities, mainframe communication, and management services.
- File and print services provide the foundation for networking. They enable multiple users to share data, applications, storage areas, and printers.
- Networks use communications services to allow remote users to connect to the network (usually through a phone line and modem) or network users to connect to machines outside the network. Communications servers are also called access servers or remote access servers.
- Mail services allow users on a network to exchange and store e-mail. Many mail packages also provide routing, scheduling, notification, document management, and gateways to other mail systems.
- Internet services such as World Wide Web servers and browsers, file transfer capabilities, addressing schemes, and security filters enable organizations to connect to and use the global Internet.
- Network management services centrally administer and simplify complicated management tasks on the network. Some organizations dedicate a number of servers to network management functions, with each server performing only one or two unique services.
- Networking professionals are currently in great demand. The more varied your skills, the better your chances for landing a lucrative and interesting job in networking. To prepare yourself, you should master a number of broad networking skills. Only then should you pick a few areas that interest you and study those specialties. Hone your communication and teamwork skills, and stay abreast of emerging technologies. Consider the tremendous advantages of attaining professional certification and get to know members of your field.
- Certification is the process of mastering material pertaining to a particular hardware system, operating system, programming language, or other software program, then proving your mastery by passing a series of exams. The benefits of certification include a better salary, more job opportunities, greater professional respect, and better access to technical support.
- To excel in the field of networking, you should hone your soft skills, such as leadership abilities, written and oral communication, a professional attitude, dependability, and customer relations.

- With the proper credentials, you can easily find a job in networking. To find the *best* job, you should perform research using the newspaper classified ads, searchable job databases on the Web, networking with colleagues, a nearby college career center, and career fairs.
- Joining an association for networking professionals can connect you with like-minded people, give you access to workshops and other educational materials, allow you to receive discounted or free software, and maybe even provide insurance benefits. Before joining an association, make sure its emphasis is appropriate for you and that you will be able to use its membership benefits.

Key Terms

A+ — Professional certification established by CompTIA that verifies knowledge about PC operation, repair, and management.

access server — See *communications server*.

address — A number that uniquely identifies each workstation and device on a network. Without unique addresses, computers on the network could not reliably communicate.

address management — Centrally administering a finite number of network addresses for an entire LAN. Usually this task can be accomplished without touching the client workstations.

addressing — The scheme for assigning a unique identifying number to every workstation and device on the network. The type of addressing used on a network depends on its protocols and network operating system.

asset management — Collecting and storing data on the number and types of software and hardware assets in an organization's network. The data collection is automated by electronically examining each network client from a server.

backup — The process of copying critical data files to a secure storage area. Often backups are performed according to a formulaic schedule.

certification — The process of mastering material pertaining to a particular hardware system, operating system, programming language, or other software program, then proving your mastery by passing a series of exams.

Certified NetWare Engineer (CNE) — Professional certification established by Novell that demonstrates an in-depth understanding of Novell's networking software, including NetWare.

client — A computer on the network that requests resources or services from another computer on a network. In some cases, a client could also act as a server. The term "client" may also refer to the user of a client workstation.

client/server architecture — The model of networking in which clients (typically desktop PCs) use a central server to share data, data storage space, and devices.

client/server network — A network based on the client/server architecture.

communications server — A server that runs communications services such as Windows NT's RAS or NetWare's NAS, also known as an access server or remote access server.

Computing Technology Industry Association (CompTIA) — An association of computer resellers, manufacturers, and training companies that sets industry-wide standards for computer professionals. CompTIA established and sponsors the A+ and Network+ (Net+) certifications.

data packet — A discreet unit of information sent from one computer on a network to another.

file server — A specialized server that enables clients to share applications and data across the network.

file services — The function of a file server that allows users to share data files, applications, and storage areas.

gateway — A combination of hardware and software that enables two different kinds of networks to exchange data.

host — A type of computer that enables resource sharing by other computers on the same network.

Internet — A complex WAN that connects LANs around the globe.

Internet services — Services that enable a network to communicate with the Internet, including World Wide Web servers and browsers, file transfer capabilities, Internet addressing schemes, security filters, and a means for directly logging on to other computers.

license tracking — Determining how many copies of a single application are currently in use on the network.

load balancing — Distributing processing activity evenly across a network so that no single device is overwhelmed.

local area network (LAN) — A network of computers and other devices that is confined to a relatively small space, such as one building or even one office.

local computer — The computer on which you are actually working (as opposed to a remote computer).

mail services — Network services that manage the storage and transfer of e-mail between users on a network. In addition to sending, receiving, and storing mail, mail services can include intelligent e-mail routing capabilities, notification, scheduling, indexing, document libraries, and gateways to other mail servers.

management services — Network services that centrally administer and simplify complicated management tasks on the network. Examples of management services include license tracking, security auditing, asset management, addressing management, software distribution, traffic monitoring, load balancing, and hardware diagnosis.

metropolitan area network (MAN) — A network that connects clients and servers in multiple buildings within a limited geographic area. For example, a network connecting multiple city government buildings around the city's center.

Microsoft Certified Systems Engineer (MCSE) — A professional certification established by Microsoft that demonstrates in-depth knowledge about Microsoft's products, including Windows 98 and Windows 2000.

network — A group of computers and other devices (such as printers) that are connected by some type of transmission media, usually wire or cable.

Network+ (Net+) — Professional certification established by CompTIA that verifies broad, vendor-independent networking technology skills such as an understanding of protocols, topologies, networking hardware, and network troubleshooting.

network interface card (NIC) — The device that enables a workstation to connect to the network and communicate with other computers. NICs are manufactured by several different companies and come with a variety of specifications that are tailored to the workstation's and the network's requirements.

network operating system (NOS) — The software that runs on a server and enables the server to manage data, users, groups, security, applications, and other networking functions. The most popular network operating systems are Microsoft's Windows NT, Windows 2000, UNIX, and Novell's NetWare.

node — A computer or other device connected to a network which has a unique address and is capable of sending or receiving data.

peer-to-peer communication — A simple means of networking computers using a single cable. In peer-to-peer communication, no single computer has more authority than another and each computer can share its resources with other computers.

peer-to-peer network — A network in which computers communicate directly with other computers on a single segment of cable and share each others' data and devices. By default, no computer in a peer-to-peer network has more authority than another, and every computer can use resources from every other computer.

print services — The network service that allows printers to be shared by several users on a network.

protocol — The rules that the network uses to transfer data. Protocols ensure that data are transferred whole, in sequence, and without error from one node on the network to another.

remote access server — See *communications server*.

remote computer — The computer that you are controlling or working on via a network connection.

remote user — A person working on a computer in a different geographical location from the LAN's server.

resources — The devices, data, and data storage space provided by a computer, whether standalone or shared.

restore — The process of retrieving files from a backup if the original files are lost or deleted.

security auditing — Evaluating security measures currently in place on a network and notifying the network administrator if a security breach occurs.

segment — A part of a LAN that is logically separated from other parts of the LAN and that shares a fixed amount of traffic capacity.

server — A computer on the network that manages shared resources. Servers usually have more processing power, memory, and hard disk space than clients. They run network operating software that can manage not only data, but also users, groups, security, and applications on the network.

server-based network — A network that uses special computers, known as servers, to process data for and facilitate communication between the other computers on the network. See *client/server network*.

services — The features provided by a network.

sneakernet — The only means of exchanging data without using a network. Sneakernet requires that data be copied from a computer to a floppy disk, carried (presumably by someone wearing sneakers) to another computer, then copied from the floppy disk onto the second computer.

soft skills — Skills such as customer relations, leadership ability, and dependability, which are not easily measured, but are nevertheless important in a networking career.

software distribution — The process of automatically transferring a data file or program from the server to a client on the network.

standalone computer — A computer that uses programs and data only from its local disks and that is not connected to a network.

topology — The physical layout of a computer network.

traffic — The data transmission and processing activity taking place on a computer network at any given time.

traffic monitoring — Determining how much processing activity is taking place on a network or network segment and notifying administrators when a segment becomes overloaded.

transmission media — The means through which data are transmitted and received. Transmission media may be physical, such as wire or cable, or atmospheric (wireless), such as radio waves.

user — A person who uses a computer.

wide area network (WAN) — A network that spans a large distance and connects two or more LANs.

workstation — A computer that typically runs a desktop operating system and connects to a network.

Review Questions

1. What resources do networks *not* enable workstations to share?
   a. data
   b. passwords
   c. printers
   d. fax machines
2. A server-based network can:
   a. allow multiple users to share applications
   b. allow multiple users to access each other's workstations
   c. allow multiple users to share floppy disks
   d. allow multiple users to share phone lines

3. What is the simplest form of a network still in use today?
   a. server-based networking
   b. thin client networking
   c. host-to-host networking
   d. peer-to-peer networking
4. Servers usually possess the same amount of memory and hard disk capacity as workstations. True or False?
5. What is the primary function of a file server on a network?
   a. It routes traffic between two or more LAN segments.
   b. It monitors how many people are logged on to a wide area network.
   c. It supplies error messages when unauthorized users try to access the network.
   d. It manages shared resources such as spreadsheet and word-processing files.
6. What is the primary difference between LANs and WANs?
   a. the distance they span
   b. the type of servers they use
   c. the type of data they transmit
   d. the transmission speed they can achieve
7. Any two computers can use the same network interface card to connect to the network. True or False?
8. Why is it important to make sure that each workstation on a network has a unique network address?
   a. to enable users to move from one workstation to another and still find their data
   b. to enable the workstation to communicate with the server and other networked workstations
   c. to enable the workstation to request priority processing from the file server
   d. to enable the user to identify his or her machine to technical support representatives
9. A shared HP Laserjet 6P could be considered a network node. True or False?
10. Which of the following is not a network topology?
    a. star
    b. bus
    c. cube
    d. ring

11. Which of the following is not true about peer-to-peer networks?
    a. They are typically very secure.
    b. They are typically inexpensive.
    c. They are typically easy to set up.
    d. They do not depend on a file server.
12. In addition to message storage and transfer, what additional function might a mail server provide?
    a. mail text search and replace
    b. address book creation
    c. mail gateways to other systems
    d. mail attachment conversion
13. Which of the following could not be considered a network management service?
    a. automated software distribution
    b. license tracking
    c. traffic control
    d. dial-up access authentication
14. Security is a concern when using communications servers on a network because:
    a. communications servers enable computers to dial into a network, thereby opening the network up to the outside world
    b. communications servers have poor password enforcement capabilities, so they rely on users to choose good passwords
    c. communications servers cannot accept encrypted data transfers, requiring users to transmit plain text to and from the network
    d. communications servers are difficult to understand and support, so many networks are using them incorrectly and perhaps insecurely
15. Which of the following services does not belong to the Internet services group of networked functions?
    a. World Wide Web browser service
    b. file transfer service
    c. Internet addressing services
    d. load balancing traffic on multiple Internet connections
16. One function that network protocols serve is to ensure that data are delivered in the correct sequence. True or False?
17. Name three specialties within the networking field that are in high demand.

18. Soft skills are probably not necessary in which of the following on-the-job scenarios?
    a. An angry customer fumes at you because you inform him that you do not have access to his mail account and cannot look up a message he sent three weeks ago.
    b. The server on which you're working continually hangs up while rebooting, and you can't find a bootable floppy disk.
    c. One of your software suppliers insists she never received an order that you faxed to her twice in the last week, and you need the software now.
    d. For several hours one morning, your network had problems that prevented any users from logging on, and now your supervisor is asking you why you didn't fix the problem sooner.
19. Which of the following is probably not a benefit of attaining professional certification?
    a. a better-paying job
    b. faster access to technical support
    c. never having to attend additional training courses
    d. more respect from technical colleagues
20. To find the best possible job in networking, what sources would you investigate?

HANDS-ON PROJECTS

Project 1-1

During your career in networking, you will frequently need to interpret network diagrams, if not design them yourself. This exercise is the first of several in this book that give you practice in drawing network diagrams.

On a separate piece of paper, draw a simple diagram of a network composed of 12 clients, 2 shared printers, 2 file servers, and a mainframe host. This network should use the bus topology.

After you have drawn a simple network based on the bus topology, try drawing the same type of network with a ring topology.

Project 1-2

Even before you are ready to look for a job in networking, you should be familiar with the kinds of employers who are looking for information systems professionals and the skills that they desire. The more research you do, the better prepared you will be when you begin job hunting in earnest. This exercise will familiarize you with searching job databases on the Web. To complete this project you need a computer with access to the Internet.

The steps in this project matched the Web sites mentioned at the time this book was published. If you notice discrepancies, look for similar links and follow the same general steps.

1. Access the Internet and go to www.monster.com.
2. From The Monster Board's home page, click **Search Jobs**.
3. Ignore the Location Search and Category Search options, and scroll down to the Keyword Search text box. Type **network administrator**, then click the **Search Jobs** button. How many jobs were returned by the search?
4. Click the first 15 job postings, one after the other, to display the job descriptions. On a separate piece of paper, note how many require or recommend each technical proficiency listed below.

   - ❒ NetWare
   - ❒ Windows 2000
   - ❒ Macintosh
   - ❒ UNIX
   - ❒ TCP/IP
   - ❒ Internet Services
   - ❒ Bridges, routers, or gateways
   - ❒ Network security
   - ❒ Printers
   - ❒ WANs

5. For each proficiency, calculate the percentage of jobs that require it.
6. How many of the position descriptions mention A+, Net+, MCSE, CCIE, or CNE certification?
7. Return to the job search page, verify that "network administrator" still appears in the Keyword "Search" (see step 3) text box, then use the Location Search list box to select the metropolitan areas in your state. How many jobs did the search return? Which areas have the most job openings?
8. Return to the "job" (see step 7) search page. In the Keyword Search text box replace "network administrator" with "manager," deselect any locations in the Location Search list box, select **Information Technology** in the Job Category Search list box, then click the **Search Jobs** button.
9. How many jobs did the search return?
10. Examine the first 15 jobs. On a separate piece of paper, note the number of these jobs that require the "soft skills" listed below.

    - ❒ Leadership
    - ❒ Oral/written communication
    - ❒ Customer relations
    - ❒ Teamwork
    - ❒ Supervision
    - ❒ Motivation (of yourself and others)

11. Continue to search The Monster Board, choosing keywords or categories for specialty areas of networking that appeal to you. Some examples might be network security, voice/data integration, or router configuration.

12. As you read the job descriptions, jot down terms and skills that are new to you, then look up their definitions in the glossary of this text.

Project 1-3

If you intend to pursue the Net+ certification, you should familiarize yourself with the Net+ exam objectives. Although these objectives are mentioned in the pertinent chapters of this book and summarized in Appendix A, you can learn more about them at the CompTIA (Computing Technology Industry Association) organization's Web site. In this exercise, you will explore CompTIA's Web site.

1. Access the Internet and go to www.comptia.org.
2. Click **Certification** to view information about the different computer certifications that CompTIA sponsors.
3. Click **Network+** to view more information about the Net+ certification. What kind of prior experience does CompTIA suggest for those aspiring to obtain Net+ certification?
4. Choose the **All About Network+** option near the bottom of the page to learn more about this certification. A new browser window opens.
5. In the new window, click **Objectives**.
6. Among other things, this page describes how different skills are weighted in the Net+ exam. For example, questions about networking technology security account for approximately 6% of all exam questions. What percentage of the exam questions pertains to TCP/IP fundamentals? What percentage of the exam questions pertains to troubleshooting the network?
7. Click your browser's Back button to return to the All About Network+ page.
8. Click on **Industry Acceptance** to view how Net+ is regarded by different networking vendors. What other certifications might passing the Net+ exam prepare you for?
9. One feature of the Net+ examination is its company-neutral approach, meaning that it does not focus solely on any one vendor's networking products. How might this neutrality benefit your networking career?

CASE PROJECTS

1. You have been asked by Thrift Towne, a local charity retail organization, to install a network in its downtown office. It currently has four PCs running Windows 98, with the following specifications:

   - 486/66 MHz processor, 200 MB hard drive, 16 MB RAM
   - 486/233 MHz processor, 500 MB hard drive, 32 MB RAM
   - Pentium 233 MHz processor, 2.5 GB hard drive, 64 MB RAM
   - Pentium II 533 MHz processor, 16 GB hard drive, 128 MB RAM

   Thrift Towne's owners are not very concerned about security, because the network will share only inventory information (customers remain anonymous and are not tracked). Thrift Towne uses volunteers to run its stores, and the volunteers are not technical experts. In addition, Thrift Towne doesn't have much money to spend on this project. The owners have asked for a simple, inexpensive solution. What type of network would you recommend and why? What role (or roles) would you assign to each of the four workstations and any other equipment you recommend? What type of upgrades might the workstations require to make your solution work?

2. Your work at Thrift Towne was so successful that you are asked to provide networking advice to a chain of ice cream stores called Scoops. Scoops already has a server-based network. The server that holds the company's inventory, ordering, sales, time tracking, and employee information and provides an Internet connection is located at their store across the street from Thrift Towne. Three other Scoops stores in town connect to a modem on the central server through dial-in phone lines. Scoops is having problems with heavy traffic and slow server response at 8:00 A.M. and 3:00 P.M. each day. They don't exactly know where the traffic originates or what type of traffic it is. They also don't know whether the two heavy traffic times every day warrant a change in their connection methods. What kind of services do you suggest will help them assess their traffic situation and provide answers about possible network expansion? What types of things can they find out? What other kinds of services might they also use, given their network configuration?

3. The owners of Thrift Towne and Scoops were so impressed with your networking abilities that they recommended you apply for a network administrator position in one of the city government offices. You applied for the job and got an interview. Although you think the interview was successful, the city's Director of Planning unfortunately didn't offer you the job because he didn't think you were qualified. In particular, he wanted you to have more hands-on experience with enterprise-wide networks. What can you do to gain that experience to make sure you don't miss another great opportunity?